

Remarks

Applicants have carefully reviewed and considered the Office Action mailed on June 17, 2003. Claims 1-62, 80, 109-110, 113-116 and 122-124 have been canceled, claims 63, 81, 84, 95, 104, and 112 have been amended; as a result, claims 63-79, 81-108, 111-112, and 117-121, and 125-129 are now pending in this application. The amendments to the claims are to clarify the subject matter the applicants regard as their invention. No new subject matter is added.

Rejections under 35 U.S.C. §112

1. Claims 81-103 were rejected under 35 U.S.C. § 112, first paragraph, as allegedly containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make, and/or use the invention. The Examiner alleges that adequate support was not provided in the specification for claiming polyurethanes molecular weights as “number average” molecular weights. This rejection is respectfully traversed.

The Examiner indicated that adequate support was not provided in the specification for claiming polyurethanes molecular weights as “number average” molecular weights. Applicant respectfully submits that the application is directed to one of ordinary skill in the art and that one of ordinary skill in the art would recognize that “number average” as the method of choice in describing polyurethane formulations and would further recognize that measures of molecular weight of polyurethanes other than number average are not useful in calculating polyurethane formulations. Applicant respectfully submits herewith an excerpt from the treatise “Polyurethane Elastomer Chemistry” which supports the use of “number average molecular weight” as a preferred way to describe the recited polyurethane-urea elastomeric compositions of claims 81-103. (See page 44, last paragraph and page 43, last paragraph. A copy of this excerpt is enclosed for the Examiner’s convenience)

In addition, Applicant directs the Examiner’s attention to page 15, lines 12, of the specification. Here the text refers to poly(hexamethylene oxide) (PHMO, MW 700.2) prepared according to

the method of U.S. Patent No. 5,403,912. In the '912 patent the poly(hexamethylene oxide) is reported in terms of M_n , number average molecular weight, and determined by size exclusion chromatography (SEC). See, Example 1 of the '912 patent. Thus, when reading the claims, it would be readily apparent to the skilled artisan, upon review of the specification and the documents cited therein, that the number average molecular weight is the proper way to determine the molecular weight of the products.

2. Claims 63-103, 117-121 and 125-129 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Examiner asserts that it is unclear how the formula (I) soft segment is to differ structurally from the chain extender of formula (I). This rejection is respectfully traversed.

In the prior amendment, claim 63 was amended to recite that the soft segment comprises “a macrodiamine compound of formula (I) and a macrodiol.” The macrodiol is a polysiloxane macrodiol, a polyether macrodiol, a polycarbonate macrodiol, or a mixture of these compounds. Thus, the soft segment only requires two components a macrodiamine having formula (I) and a macrodiol. In contrast, The hard segment is formed from “a diisocyanate and diamine compound of formula (I).”

Thus, the hard segment differs from the soft segment because the hard segment includes a diisocyanate and the soft segment does not require the diisocyanate. Both segments can use the same macrodiamine compound of formula (I) and have different properties (hard v. soft) because when the compound of formula (I) is reacted with a diisocyanate, as required in the hard segment, it forms different groups than when it is reacted with a macrodiol, required in the soft segment. Therefore, because the soft segment requires a macrodiol and the hard segment requires a diisocyanate, it is believed that these segments are distinguish by name (hard v. soft), disposition in the polymer segments, and by the polymer composition.

3. Claims 81-102 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. This rejection is respectfully traversed.

Claim 81 has been amended to clarify the subject matter that Applicants regard as their invention. The amendment is to indicate that n is an integer from about 5 to about 100. This is supported by applicants specification.

4. Claims 63-103, 117-121 and 125-129 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. This rejection is respectfully traversed.

Claim 63 has been amended to clarify the subject matter that Applicants regard as their invention. The amendment is to delete the second occurrence of "a".

5. Claims 80 and 84-102 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. This rejection is respectfully traversed.

Applicants have cancelled claim 80 and amended claims 84, and 95. Thus, it is believed that, as amended, all claims further limit the claim form which they depend.

6. Claims 104-108 and 112 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. This rejection is respectfully traversed.

Claims 104 and 112 has been amended to clarify the subject matter that Applicants regard as their invention. These claims have been amended to cancel the inclusion of the tetramethyl-disiloxanes as chain extenders.

7. Claims 125-129 were rejected under 35 U.S.C. § 112, first paragraph, as allegedly containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventor(s), at the time the application was filed, had possession of the claimed invention. This rejection is respectfully traversed.

The Examiner has objected to the claims because allegedly the composition tested does not correspond to the composition of claim 63. Applicants disagree with the Examiner and note that composition 2 (from Example 3) includes the macrodiamine (PDMS), the macrodiol (PHMO), and a diisocyanate, MDI. Thus all the required components of the soft and hard segments are present and the composition of the example meets the limitation of the claims.

Further, the examiner alleges that because the values disclosed are recited as data points that they are insufficient to support the claiming of ranges. Applicants disagree and respectfully submit that the specific data points are sufficient to support the limits of ranges. Thus, applicants submit that they were in possession of the claimed ranges and that claims 126-128 are properly supported.

Accordingly it is respectfully requested that the rejections under 35 U.S.C. 112 be withdrawn.

Rejection under 35 U.S.C. §103

9. Claims 63-108, 111, 112, 117-121, and 125-129 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Szycher et al. U.S. 5,863,627 (Szycher '627) or WO 98/13405 or JP 4-

248826, each in view of Li et al. U.S. 5,221,724 (Li '724) and Ohtaki et al. U.S. 5,861,085 (Ohtaki '085).

Applicants note that the Examiner has indicated (paragraph 12) that in his view the claims did not differentiate the soft segment from the hard segment. As indicated above, in the instant claims, the soft segment requires two components a macrodiamine having formula (I) and a macrodiol. In contrast, The hard segment is formed from “a diisocyanate and diamine compound of formula (I).” Therefore, the hard segment differs from the soft segment because the hard segment includes a diisocyanate and the soft segment does not require have a diisocyanate. Both segments can use the same macrodiamine compound of formula (I) and have different properties (hard v. soft) because when the compound of formula (I) can react with a diisocyanate, as required in the hard segment, where it forms the polyurethane (hard segment) portion of the composition and it can be combined with a macrodiol to provide the soft segment. Therefore, because the soft segment requires a macrodiol and the hard segment requires a diisocyanate, these segments are distinguish by name (hard v. soft), disposition in the polymer segments, and by the polymer composition.

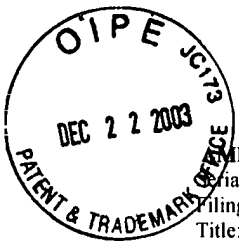
It is respectfully submitted that because the hard and soft segments can be distinguished from each other that the arguments for non obviousness from the previous amendment are proper. None of the cited documents disclose or suggest the claimed polyurethane-urea compositions where the soft segment contains a silicone containing macrodiamine and macrodiol compound of formula (I) and a silicone containing diamine in the hard segment as in the presently claimed invention.

In the previous Office Action, The Examiner conceded that the primary documents (Szycher '627, WO 98/13405, and JP 4-248826) do “[not] disclose the specific use of an amine functional siloxane as a chain extender” (Official Action, mailed on 11/2//02, page 6) as in the present invention. The Examiner asserted that Li '724 discloses the use of compounds of formula (I) in biocompatible polyureas and polyurethane-ureas.

Applicant's claims distinguish the soft and hard segments and as discussed above. The secondary documents do not teach the desirability of incorporating the diamine compounds of formula (I) into a hard segment, alone or in combination with the soft segment, a macrodiamine compounds of formula (I) and a macrodiol, of the recited polymers.

None of the primary documents {Szycher '627, WO 98/13405, or JP 4-248826; each in view of Li '724 and Ohtaki '085}, alone or in combination, disclose or suggest all of the elements of the presently claimed invention. Specifically, none of these documents disclose or suggest the use of a diamine compound of formula (I) as a chain extender in the hard segment with a diisocyanate as in compositions of the present invention. Additionally, none of these documents disclose or suggest polyurethane-urea compositions where the soft segment contains a silicone containing macrodiamine and macrodiol compound of formula (I) and a silicone containing diamine in the hard segment as in the present invention. Thus, because none of these documents, alone or in combination, provide all of the elements of the claimed invention they cannot provide the motivation to combine or provide any reasonable expectation of success in arriving at the present invention.

Thus, it is respectfully submitted that the claimed invention is not obvious over the cited documents in an combination. Accordingly, Applicant respectfully request withdrawal of the rejection of the present claims under 35 U.S.C. § 103(a).



AMENDMENT AND RESPONSE TO OFFICE ACTION

Serial Number: 09/933,938

Filing Date: August 21, 2001

Title: SILOXANE-CONTAINING POLYURETHANE-UREA COMPOSITIONS

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Dkt: 1207.008US1

Conclusion

Applicant respectfully submit that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicants' attorney ((612) 359-3270) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this 17th day of December, 2003.

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Polyurethane Elastomers

Second Edition

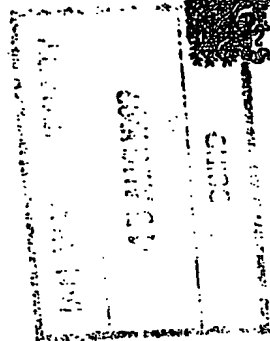
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POLYURETHANE ELASTOMERS

or

$$\bar{M}_n = \sum_{i=1}^r n_i \bar{M}_i / \sum_{i=1}^r n_i$$

$$n_i \bar{M}_i = W_i$$

(2) For a two-component mixture

$$\bar{M}_n = \frac{n_j \bar{M}_j + n_k \bar{M}_k}{n_j + n_k}$$

where j, k = individual components.(b) Molecular weight for a two-component mixture:
average molecular weights (\bar{M}_n):
Molecular weight of mixture:

$$\bar{M}_n = \frac{\bar{M}_j \bar{M}_k}{(\bar{M}_j)(\alpha) + (\bar{M}_k)(1-\alpha)}$$

where α = fractional weight of first component, and $(1-\alpha)$ = fractional weight of second component.

Weight-Average Molecular Weight
Weight-average molecular weight \bar{M}_w equals the sum of the weights of each species multiplied by the molecular weight of each corresponding species, divided by the total polymer weight. The contribution of each molecular weight class to the weight-average molecular weight is proportional to the weight of the molecule in that class. This average is seldom used in polyurethane calculations, and then only when the molecular weight is calculated from viscosity, light scattering and ultracentrifuge data. Weight-average and number-average molecular weights cannot be used interchangeably; they are equivalent only in the case of pure compounds.

The weight-average molecular weight can be described mathematically as follows:

(a) General form:

$$\bar{M}_w = \sum_{i=1}^r W_i \bar{M}_i / \sum_{i=1}^r W_i$$

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or

$$\bar{M}_w = \sum_{i=1}^r n_i (\bar{M}_i)^2 / \sum_{i=1}^r n_i \bar{M}_i$$

$$n_i \bar{M}_i = W_i$$

(b) Component system:

(1) Molecular weight of mixture

$$\bar{M}_w = (\bar{M}_j)(\alpha) + (\bar{M}_k)(1-\alpha)$$

(2) Component weights for a desired \bar{M}_w

$$\alpha = \frac{\bar{M}_w - \bar{M}_k}{\bar{M}_j - \bar{M}_k}$$

Example Calculation for a Typical Polyurethane Elastomer Synthesis

Many suppliers of polyurethane systems provide them in the form of two components and advise on the actual weight of each component to be combined to form the polymer. This is the *weight ratio*, sometimes and confusingly called the index. Such a practice is to be decried as causing confusion with the chemical term 'isocyanate index'. In many cases there is little difference in value between weight ratio and chemical equivalent weight ratio of index but it is important to understand the difference. Most suppliers supply an NCO-free system for one component and an NCO component (quoted in terms of the OH number) for the other side.

Example Calculation

Polyol alone. Consider the following arbitrary formulation:

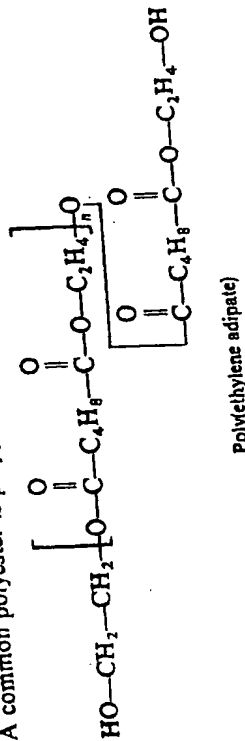
	Mix B (parts by weight)
Polyol (OH number 310)	100
10% active surfactant (carried by plasticizer)	10
Catalyst system	4
Other ingredients, fillers, etc.	20
	134

$$\text{Equivalent weight} = \frac{56100}{310} = 181$$

This is the equivalent weight of the polyol alone.

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A common polyester is poly(ethylene adipate):



Hydroxyl Content
 Polyols are identified by their hydroxyl numbers. If the polyol is initiated by ethylene glycol, and the polyol can be identified as a diol, with a functionality of 2, the average molecular weight can be determined. Hydroxyl number is defined as the number of milliequivalents (or milligrams) of potassium hydroxide (KOH) in the active functions (hydroxyl content) of 1 g of the compound or polymer.

$$\text{Hydroxyl number} = \frac{56.100}{\text{Equivalent weight}}$$

Note: 56.100 is the molecular weight of potassium hydroxide (KOH) used in the analyses expressed in milligrams, i.e. $\text{KOH}, 39.1 + 16 + 1 = 56.1, 56.1 \times 1000 = 56.100$.

If the analysis of polyol indicates that the hydroxyl number is 48.3, then

$$\text{Equivalent weight} = \frac{56.100}{48.3} = 1162$$

Note:

$$\text{Hydroxyl number} = \frac{(\text{Functionality})(56.100)}{\text{MW polyol}} = \frac{56.100}{\text{MW polyol}} \times \text{Functionality}$$

Other Isocyanate Analytical Terms

Isocyanate Index
 As the chemical reaction occurs on a 1:1 equivalent weight basis, 1162 g of this polyol would react with 125 g of MDI, or 110.5 g of the 'polymeric'

MDI discussed earlier. This 1:1 equivalent weight ratio is called the isocyanate index.

$$\text{NCO index} = \frac{\text{Isocyanate equivalents}}{\text{polyol equivalents}}$$

Note: Normally excess isocyanate is used to compensate for allophanate and biuret readings.

Isocyanate Equivalent

The isocyanate equivalent is defined as the weight of sample which will combine with 1 g equivalent weight of phenyl isocyanate. The sample is generally a polyol, amine or other compound that possesses groups capable of reacting with an isocyanate.

Amine Equivalent

Amine equivalent is defined as the weight of sample which will combine with 1 g equivalent weight of isocyanate.

$$\text{Theoretical amine equivalent} = \frac{\text{No. average molecular weight}}{\text{No. of reactive groups or functionality}}$$

Other Useful Terms

Number-Average Molecular Weight

Number-average molecular weight \bar{M}_n equals the total polymer weight divided by the total number of moles of polymer molecules. The usual definition is: Number-average molecular weight equals the sum of the number of moles of polymer molecules of each species multiplied by the molecular weight of each corresponding species, divided by the total number of moles of polymer molecules. This average, where each molecule contributes equally, independent of its weight, is most useful in polyurethane formulation calculations since it is inversely proportional to the number of active groups, that is the hydroxyl number. This can be mathematically described as follows:

(a) General form:

$$(1) \quad \bar{M}_n = \frac{\sum W_i}{\sum \frac{W_i}{M_i}} = \frac{\sum W_i}{\sum n_i}$$

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